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### THREE RARE GOMPHIDS FROM THE LOWER CONNECTICUT RIVER

Three gomphids new to the Connecticut state fauna (Garman 1927) were discovered on sandy beaches of the Connecticut River in Middlesex County, Connecticut: *Gomphus fraternus* (Say), *Stylurus amnicola* (Walsh), and *Stylurus spiniceps* (Walsh). All three are rare in New England and there is but little known about the biology of the two *Stylurus* species (Garman, 1927; Howe, 1918; Walker, 1958).

Sandy beaches at Cromwell and Portland were visited three to four times a week from 5 June until through 18 August, 1995; on average a 200 to 300 m stretch of beach was walked continuously for a period of five hours during a visit. At both sites the river is broad (ca. 500 m) and without riffles. The beaches, though more than 25 miles from the ocean, are tidal with daily water levels often fluctuating as much as 1 m. Small waves continually influence the shoreline. Sands are fine and compacted, grading to mud and clay in places.

*Gomphus fraternus* was observed on the first visit (5 June); the last individual noted was a worn female on 24 July. Over the first few weeks 4–12 individuals were seen per visit. Adults landed on sandy areas along the river, well above the current water level, but away from the shoreline vegetation.

Eclosing and teneral adults of *Stylurus* were first found in early July at the Portland site. Both *Stylurus* species were initially thought to be emerging individuals of *Gomphus fraternus*, so little data was collected until the 19th of July, when we realized our mistake. The next day we arrived by 0830 hr and walked a 200 m section of the Portland beach until 1600 hr. Five individuals of *Stylurus spiniceps* and one of *S. amnicola* emerged between 1230 and 1430 hr, roughly corresponding to the period of low tide on that date. Additional emergence data are given in Table 1. On most sunny days in July and early August we could count on seeing 4 to 6 individuals emerging; the most we saw on any day was 10. We observed emergences between 1000 and 1700 hr, with activity peaking during tidal lows that were accompanied by sun. Exuviae were collected from beaches on 20 July, 1 August and 4 August, 1995, primarily from the wrack line: these included 32 *S. spiniceps* and 7 *S. amnicola*. In the center of the Portland beach, we found 1 or 2 *Stylurus* exuviae per liner foot of shoreline (on 20 July). Where the beach narrowed, exuviae were found among the roots of shoreline shrubbery.

Eclosing larvae left distinctive zipper-like tracks which extended to or above the wrack line, although the occasional individual eclosed closer to the water. We found

Table 1. Recorded *Stylurus* emergences from Portland. Numbers reflect all individuals encountered on 20 and 31 July and 1 and 14 August. On other dates numbers reflect only the collected sample of eclosing individuals—most individuals were not collected or disturbed.

Date	<i>Stylurus spiniceps</i>		<i>Stylurus amnicola</i>		<i>Stylurus</i> spp.
	Male	Female	Male	Female	
20 Jul	3	2	1		
23 Jul	2				
24 Jul	1				
27 Jul	1				
31 Jul	1	1	1		
1 Aug					4
4 Aug		1			
14 Aug	1				

many aborted emergence “trails,” half-consumed larvae, and older damaged exuviae in the beach wrack which collectively indicated the population was under considerable predation pressure. On 23 July, a gray catbird (*Dumetella carolinensis*) was seen eating an emerging individual, while two others worked nearby beaches in a sandpiperlike fashion—of six *Stylurus* trails found on this date, bird tracks were associated with all five where we were unable to locate an eclosing or adult dragonfly. Beak marks were associated with the terminus of three aborted trails (including the *Stylurus* larva that was observed being taken).

A stereotyped eclosion process was documented for approximately 15 individuals. Typically, they crawled onto the beach about 0.5 m to 0.75 m and paused for 5 to 10 min and then proceeded another 1–2 m before again stopping for a period of 10 min ( $N = 10$ ). During this second quiescent period larvae drew the tip of the abdomen over the body and excreted a single drop of fluid over the thoracic midline—this behavior was repeated three or four times in all 15 of the emergences we witnessed. The larvae then crawled farther shoreward, onto drier sand or vegetation, where they completed their emergence. During the first 10 min of eclosion the teneral splits open the larval shell and pulls its head and thorax free. Once completely free from the exuviae, it invariably takes only 5 to 6 min to fully expand the wings ( $N = 15$ ). The entire process takes only 30 to 40 min. Minutes after expansion of the wings, adults are able to fly short distances (1 to 5 m) but do so only if disturbed. After 60 to 75 min individuals are capable of sustained flight into nearby vegetation ( $N = 10$ ).

Over the five-week period when *Stylurus* was known to be on the wing, virtually no activity was noted over the water close to shore (the river is close to 200 m wide at Portland). A single individual which may have represented *S. spiniceps* was seen at 0930 hr over the river on 20 July. Many individuals of a gomphid-like dragonfly were noted to perch in treetops along the river, at heights of more than 15 m. We returned to the site twice in late afternoon and remained through dusk to determine if adults were crepuscular as suggested by Kellicott (1899). No individuals were seen over the river or in the trees on either visit.

Approximately ten (non-emerging) *Stylurus* larvae were seen relocating to deeper water during very low tides. Tracks indicated that several of the larvae had been

crawling across the river bottom, but upon exposure at the water's edge, had crawled or swam in short bursts into deeper water. All buried themselves in fine sands, in just a few seconds, just one to two feet from (the low tide) shore.

Teneral adults were caged and brought into the laboratory and held for up to two weeks. Initially we fed newly emerged adults margarine on a wooden stick by depositing small globs between their mandibles—only about half accepted this diet. Better success was achieved when adults were hand-fed laboratory-reared crickets. Adults also imbibed water that was misted into their screened enclosures daily. Adults lived up to two weeks, when our efforts to maintain them were terminated.

All three are species of sandy sections of large rivers (Walker, 1958; K. Soltesz, personal communication). Although these gomphids are broadly distributed in the East, they tend to be local and rare. In New England, *Stylurus spiniceps* was known only from a few sites in New Hampshire and Massachusetts; the other two were known only from the latter state (Howe, 1918; White and Morris, 1973; Carpenter, 1991; S. Roble, personal communication). All are ranked as "S1" taxa by the Massachusetts Natural Heritage and Endangered Species Program, i.e., they are species believed to be very rare, with five or fewer occurrences within the state.

The dragonfly fauna of Connecticut was monographed in 1927 by Garman, and has been relatively well collected since. The discovery of three clubtail species—new to the state fauna—on a single beach of the Connecticut River is testimony to the uniqueness and importance of the sandy beach—sandbar ecosystem of the river. No doubt, these beaches are home to additional regionally rare areniphilous species (e.g., asilids, therevids, and ground-nesting Hymenoptera), and every effort should be made to protect these sites from development, heavy foot or vehicular traffic, and pollution—David L. Wagner, *Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut 06269*, Denise M. Simmonds, *The Connecticut Nature Conservancy, 55 High Street, Middletown, Connecticut 06457*, and Mike C. Thomas, *206 Skyview, Cromwell, Connecticut 06416*.

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